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ATTORNEY'S DOCKET NUMBER

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DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

1326

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/647513

INTERNATIONAL APPLICATION NO.
PCT/DE 00/00243INTERNATIONAL FILING DATE
JANUARY 31, 2000PRIORITY DATE CLAIMED
FEB. 1, 1999, OCT. 28, 1999, DEC. 15, 1999

TITLE OF INVENTION

DRIVE ARRANGEMENT FOR AT LEAST ONE MOTOR VEHICLE AUXILIARY SYSTEM, AND METHOD FOR
OPERATING THE DRIVE ARRANGEMENT

APPLICANT(S) FOR DO/EO/US

Siegfried SCHUSTEK, Ulrich HESSE, Daniel DAMSON, Hans-Ruediger WEISS, Klaus-Peter SCHNELLE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EK 957561775 US

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20. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Search Report has been prepared by the EPO or JPO \$930.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) \$720.00
- ☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$790.00
- ☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,070.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$98.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$970.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

\$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	17 - 20 =	0	x \$18.00
Independent claims	2 - 3 =	0	x \$78.00

\$0.00

\$0.00

Multiple Dependent Claims (check if applicable). ☐

\$0.00

TOTAL OF ABOVE CALCULATIONS =

\$970.00

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐

\$0.00

SUBTOTAL =

\$970.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

\$0.00

TOTAL NATIONAL FEE =

\$970.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐

\$0.00

TOTAL FEES ENCLOSED =

\$970.00

Amount to be:

\$

refunded

\$

charged

\$

- ☐ A check in the amount of _____ to cover the above fees is enclosed.
- ☒ Please charge my Deposit Account No. **19-4675** in the amount of **\$970.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.
- ☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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27233

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SEPTEMBER 29, 2000

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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:

Group:

Attorney Docket # 1326

Applicant(s) : SCHUSTEK, S., ET AL

Serial No. :

Filed : Simultaneously

For : DRIVE ARRANGEMENT FOR AT LEAST ONE
MOTOR VEHICLE AUXILIARY SYSTEM, AND
METHOD FOR OPERATING THE DRIVE
ARRANGEMENT

SIMULTANEOUS AMENDMENT

September 29, 2000

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application
please amend the same as follows:

In the Claims:

Claim 5 line 1 delete "one of claims 2 or 3 claims", substitute with "claim 2".

Claim 7 line 1 and 2 delete "one of the foregoing claims", substitute with "claim 1".

Claim 8 line 1 and 2 delete "one of the foregoing claims", substitute with "claim 1".

Claim 11 line 1 and 2 delete "one or more of the foregoing claims",
substitute with "claim 1".

Claim 16 line 1 delete "one of claims 13-15", substitute with "claim 13".

Claim 17 line 1 delete "one of claims 13-16", substitute with "claim 13".

REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Michael J. Striker", written over the printed name.

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

DRIVE ARRANGEMENT FOR AT LEAST ONE MOTOR VEHICLE
AUXILIARY SYSTEM, AND METHOD FOR OPERATING THE DRIVE
ARRANGEMENT

5 The invention relates to a drive arrangement for
at least one auxiliary system of a motor vehicle, having
the characteristics recited in the preamble to claim 1,
and to a method for operating such a drive arrangement,
having the characteristics recited in the preamble to
claim 13.

10 Prior Art

Drive arrangements of this generic type are known
and are used for instance in motor vehicles. An
internal combustion engine is typically used as the
drive arrangement for the motor vehicle. The engine can
also be used to operate numerous auxiliary systems.
Such auxiliary systems must often be operated in a
certain rpm range, so that it is known to make a
suitable gear ratio possible via an intervening gear.
However, since a power requirement by the auxiliary
systems is usually independent of the power requirement
of the drive arrangement, it has proved to be
advantageous for a supplementary motor for operating the
auxiliary systems to be integrated into the motor
vehicle. Thus the supplementary motor furnishes a
torque, independently of a dynamic driving situation of
the motor vehicle, that can be utilized to operate the
auxiliary systems. The supplementary motor may be a
second internal combustion engine or can also be
designed as an electric machine.

It is also known to make a reinforcing torque available for operation of the auxiliary systems by the engine. However, in the known arrangements the engine is coupled directly with a starter generator; that is, a torque of the engine is first converted into an electrical output, and to operate nonelectrical auxiliary systems this must be converted in turn into a mechanical power. The resultant efficiency overall is accordingly highly unfavorable.

The disadvantages of known drive arrangements are especially apparent in the operation of climate control compressors. While it is known to operate such compressors directly via the engine, in that case the power design of the compressor must be made in accordance with an idling rpm of the engine. On the one hand this leads to oversized climate control compressors, and on the other it has proved unfavorable for auxiliary systems of this type to be associated directly with the engine. In an acceleration process, for instance, or an engine starting phase, torque requirements of the climate control compressor can impede the dynamic driving operation or starting. As a remedy, it is therefore known to integrate a second climate control compressor, which is electrically operated, into the motor vehicle. The electrical drive is typically done via the starter generator and via the on-board battery. Besides the increased expenditure of material, however, it is disadvantageous that the conversion efficiency of the starter generator and the efficiency of charging and discharging the on-board battery are not optimal from the energy standpoint and thus in the final analysis mean increased fuel consumption.

In addition, planetary gears are known in which at least one planet wheel orbits around a stationary sun wheel. A power takeoff in planetary gears can selectively be done via an output shaft that is connected operatively to the planet wheel and/or the sun wheel. Also engaging the planetary gear are two input shafts, which independently of one another transmit a torque from which the torque of the output shaft results. A speed increase of the input rpm of the input shafts relative to the output rpm of the output shafts can be selected by means of a suitable design of the planetary gear. A design of the power takeoff is highly variable and can be done for instance via a hollow wheel that is operatively connected to the planet wheel.

Advantages of the Invention

The drive arrangement of the invention has the advantage that operation of the auxiliary systems can be done both via the at least one supplementary motor and via the internal combustion engine. In certain driving situations, such as during starting or during passing, the torque for operating the auxiliary systems can be made available for the most part by the supplementary motor, while in normal driving operation, for instance beyond a certain rpm of the engine, the operation is done predominantly via the torque made available by the engine. Such an operation can be achieved by providing that the gear is a planetary gear, which is operatively connected to the engine and the at least one supplementary motor, each via a respective input shaft, and to the auxiliary system via an output shaft.

The supplementary motor can be a second internal

combustion engine, which is put into operation only when the vehicle is at a stop. Not all the auxiliary systems, such as a generator, the climate control compressor, a servo pump or a water pump, necessarily have to be driven via an output shaft of the planetary gear. In driving operation, the drive can be done via the drive motor, which has advantages in terms of energy. This system has energy advantages, since the differential efficiency, as a ratio of the required drive power for the auxiliary systems to the additional fuel consumption, is higher overall. The supplementary motor can also be an electric machine, such as a starter generator of the internal combustion engine. Hence via the starter generator, it is possible in certain operating situations to operate the climate control compressor, for instance.

It is also advantageous that often, lower rpm levels than are specified by the engine are needed for optimally efficient operation of auxiliary systems. This can be achieved in a simple way by means of a gear ratio of the planetary gear. In particular, the planetary gear can be a component of a vehicle transmission. This is especially advantageous in the case of a transmission including a total of two electric machines and two planetary gears. Then the auxiliary system is driven by one of the available transmission shafts.

The drive of the drive arrangement can advantageously be done in that

(a) the gear is a planetary gear with at least two input shafts and at least one output shaft, and a torque

is transmitted from the engine and the at least one supplementary motor via a respective one of the input shafts, to the output shaft and subsequently to the auxiliary system; and

5 (b) a control unit is assigned to the drive arrangement and detects an rpm of the output shaft and governs the supplementary motor as a function of the rpm.

10 If the at least one supplementary motor is an electric machine, then the moment can also become negative, because then the supplementary motor is functioning as a generator. The rpm of the output shaft of the drive arrangement can be detected by means of a sensor and evaluated in a suitable control unit. After that, the supplementary motor can then be controlled as a function of the detected rpm. By means of such an arrangement, the operation of the auxiliary system can be done within a predetermined, defined rpm range (set-point range), or at a predetermined rpm (set-point value).

20 In motor vehicles, the operation of such a drive arrangement can for instance be done such that as a function of a basic rpm or medium rpm of the engine, a force transmission of the supplementary motor is controlled. For instance, if the rpm of the output shaft of the drive arrangement is below a limit value, then an additional force transmission takes place via the input shaft of the supplementary motor. If the rpm is higher than the limit value, then a force input from the supplementary motor is reduced. In the latter case, 30 if the supplementary motor is an electric machine, it

can be operated with the aid of suitable control means as a generator or electric brake, including a reversal of its direction of rotation, so that any slip of the engine that occurs is converted into electrical energy.

5 The drive arrangement according to the invention has proved to be especially advantageous if the auxiliary system to be operated is a climate control compressor. On the one hand, by being decoupled from the idling rpm of the engine, the climate control
10 compressor can be designed to be smaller. Losses of the kind that occur in modern regulated climate control compressors in the partial-load range can be averted. On the other, the reinforcement of the torque required by the climate control compressor that is offered by the supplementary motor provides still further advantages in the operation of the motor vehicle in certain driving situations. For instance, the climate control
15 compressor can be operated continuously even if the engine is turned off for the sake of a fuel-saving start-stop mode. Furthermore, if the drive arrangement makes especially high power demands of the engine, the power of the supplementary motor can be increased accordingly, so that for a short time the full power of the engine can be utilized to drive the motor vehicle.
20 In the case where the supplementary motor is an electric machine (and especially a starter generator), air conditioning while parked, or precooling of the motor vehicle, can be done.

25 Control of the supplementary motor can advantageously be done as a function of a driving situation (such as being stopped or moving) and an engine operating state (such as turned off, or running).
30

For instance if the vehicle is stopped and the engine is turned off, then first, idling is selected via a transmission converter. The drive of the auxiliary system (such as the climate control compressor) then takes place via the electric machine (for instance, the starter generator). In climate control compressors, it has proved advantageous to limit a maximum rpm and/or rpm spread, for the sake of unimpeded operation. This can be achieved for instance with a spur gear stage and/or a reversible step- up gear that precedes the climate control compressor.

Further preferred features of the invention will become apparent from the other characteristics recited in the dependent claims.

Drawings

The invention will be described below in terms of an exemplary embodiment in conjunction with the associated drawings.

Fig. 1 is a schematic block circuit diagram of a first drive arrangement, with an electric machine as a substitute motor;

Fig. 2 is a schematic sectional view through a gear of a drive arrangement;

Fig. 3 is an rpm graph for a drive arrangement of the invention;

Fig. 4 is a schematic plan view on a second drive arrangement, with a second internal combustion engine as

a supplementary motor; and

Fig. 5 is a basic circuit diagram of a drive arrangement with a vehicle transmission with two electric machines, one internal combustion engine, and a climate control compressor as an auxiliary system.

Description of the Exemplary Embodiment

In Fig. 1, a schematic block circuit diagram of a drive arrangement 10 in a first exemplary embodiment is shown; the drive arrangement 10 comprises an internal combustion engine 12, an electric machine 14 as a supplementary motor 13, and a gear 16. The engine 12 is connected to the gear 16 via an input shaft 18, and the electric machine 14 is connected to the gear 16 via an input shaft 20. An auxiliary system 22 is also shown, which is operatively connected to the gear 16 via an output shaft 24 and a free-wheel coupling 23. By means of a sensor 26, a rotary speed or rpm of the output shaft 24 can be detected and transmitted over a data line 28 to a control unit 30, from which an operation of the electric machine 14 can be controlled.

As much as possible, the operation of the auxiliary system 22 should be done at a favorable rpm (set-point value) or in a favorable rpm range (set-point range) of the output shaft 24. By means of the drive arrangement 10, this rpm range can be achieved in a simple way and with overall favorable efficiency. The rpm range has an upper and a lower limit value.

First, a torque from the engine 12 is transmitted to the gear 16 via the input shaft 18 and then from the

gear 16 to the output shaft 24. If the rpm of the output shaft 24 is less than the lower limit value, then in addition a torque is transmitted to the gear 16 by means of the electric machine 14 via the input shaft 20. If the rpm of the output shaft 24 exceeds the upper limit value, then first an excess power of the engine 12 is output as slip, and second an undesired force transmission by the electric machine 14 is prevented. In the latter case, however, the slip can also be utilized to generate electrical energy, by operating the electric machine 14 as a generator using suitable control means. The electric machine 14 can also be operated as an electric brake.

By means of the control unit 30, on the one hand the rpm of the output shaft 24 can be both detected and governed via the sensor 26. On the other, the control unit 30 serves to set an operating state of the electric machine 14. As already explained, the electric machine 14 is then selectively switched as a generator or as a drive means.

Fig. 2 shows a sectional view of the gear 16 of the drive arrangement 10. The gear 16 is a planetary gear 32, with a sun wheel 34 and the planet wheels 38. The sun wheel 34 is solidly connected to the input shaft 20 of the electric machine 14 and has a set of teeth which mesh with a complimentary set of teeth of the planet wheels 38. The planetary gear 32 also has a carrier 36, which is operatively connected on the one hand to the planet wheels 38 and on the other to a pulley 46, which has a set of teeth 48. By means of a tension means (belt), not shown here, the torque of the engine 12 is transmitted to the pulley 46 and

subsequently to the planet wheels 38.

5 The planet wheels 38 are also assigned a hollow wheel 40 with suitable tothing, and this wheel is solidly connected to a further pulley 42 that has a set of teeth 44. Via a further tension means (belt) not shown here, which is seated on the pulley 42, a force transmission takes place to the input shaft 24, also not shown here, of the auxiliary system 22.

10 Instead of the pulleys 42, 46, suitable gear wheels can also be used for transmitting force between the planetary gear 32 and the engine 12, or the auxiliary system 22. The number of planet wheels 38 can also be varied, and by a suitable design of the planetary gear, a desired gear ratio can be realized.

15 Along with the power takeoff shown in Fig. 2, in which the sun wheel 34 transmits the torque of the input shaft 20 of the electric machine 14 only indirectly via the planet wheels 38, gears 16 are also conceivable in which a direct force transmission from the sun wheel 34 and an indirect force transmission from the planet wheels 38 via the sun wheel 34 are achieved. In that case, a gear wheel, not shown here, is operatively connected in a suitable way to the sun wheel 34 and the output shaft 24. Thus even a plurality of auxiliary systems 22 can be driven at least two gear ratios. If 20 the power takeoff is effected via the planet wheels 38, then gear ratios in a range of about 1.25 to 1.67 are preferred, and if power takeoff is via the sun wheel 34, gear ratios of about 2.5 to 6 are preferred.

25 30 Fig. 3, in two examples of graphs, show how

control and/or governing of the electric machine 14 can be done in the drive arrangement 10. An rpm 50 of the output shaft 24 of the drive arrangement 10 is plotted in the upper graph. It is understood that the value 50 of the rpm can be selected to meet the requirements of the auxiliary system 22 to be operated. Based on a basic rpm 52 of the engine 14, which here as an example is 1000 rpm, a straight line 54 extends up to a maximum rpm 56 of the engine 14. To keep the rpm 50 of the output shaft 24 constant, power must therefore either be supplied or taken away. In the latter case, the excess power can remain unused in the form of a slip, or it can be utilized to drive a generator. Since the supply of power below the rpm 50 is effected via the electric machine 14, it is especially advantageous to design the electric machine such that above the rpm 50, it can be operated as a generator.

The power of the electric machine 14 is shown as a function of the rpm of the engine 12 in the lower graph in Fig. 3. This clearly shows that up to a point 58, at which the rpm of the engine 12 is below the rpm 50, a suitable power is contributed by the electric machine 14. If the rpm of the engine 12 exceeds the rpm 50 of the output shaft 24 at the point 58, then the electric machine 14 is switched here in such a way that it can be operated as a generator. To prevent overheating in the generator mode, the transmitted power at high rpm levels of the engine 12 can be limited and remain unused as slip, so that a power curve 60 of the electric machine 14, at relatively high rpm levels of the engine 12, has a degressive course. Control of the electric machine 14 can - as already explained - be effected via the control unit 30.

Possible examples of auxiliary systems 22 of the motor vehicle to be operated are a generator, servo pump, water pump, oil pump, or in particular a climate control compressor. The latter can be made smaller in terms of its dimensions than in conventional drive arrangements, in which the climate control compressor is operated directly via the engine 12, because an rpm range of the climate control compressor does not have to be adapted to an idling rpm of the engine 12. To enable precooling of the motor vehicle or cooling while it is parked, the climate control compressor can be operated via the electric machine 14. The electrical power is then converted into a mechanical power via the gear 16. Thus if the engine 12 is turned off for the sake of a start-stop mode of the motor vehicle, the torque required by the climate control compressor can be furnished by the electric machine 14, thus assuring continuous cooling of the motor vehicle interior.

Fig. 4 shows a schematic plan view on a further drive arrangement 10, in which the supplementary motor 13 is a second internal combustion engine 15. As already explained, the torques are transmitted to the gear 16 via the input shafts 18, 20, resulting in a torque for the output shaft 24 that is utilized for operating the auxiliary system 22.

In the exemplary embodiment, a total of two auxiliary systems 22 are coupled to the gear 16. For instance, on the one hand a generator 23 can furnish electrical energy, which is fed into an on-board electrical system 25. After that, the electrical energy can be used to operate electric auxiliary systems 27. On the other hand, the climate control compressor 29 is

also supplied with the energy it requires for operation,
via the gear 16. Control of the second engine 15 can be
done in the same way as already explained in the
exemplary embodiment above. For the sake of simplicity,
the control unit 30 required for this purpose has
therefore not been shown.

Fig. 5 shows a basic circuit diagram of a drive
arrangement 10 with a special vehicle transmission 74,
an internal combustion engine 12, and a climate control
compressor 70 that can be operated therewith. The
vehicle transmission 74 in turn includes a planetary
gear 32, to which a first electric machine E1 is
assigned. It also includes a second planetary gear,
with a second electric machine E2. The output shafts 24
and 26 are connected to the drive shaft 27 of the
vehicle drive train via sliding cuffs S. The gear 16 of
this exemplary embodiment also has a schematically shown
transmission converter 72 with a total of three sliding
cuffs S, which make it possible to set a gear ratio or
idling. With the arrangement shown, the following
operating modes can be achieved:

- If the vehicle is in motion and the engine 12 is
in operation, the drive of the climate control
compressor 70 continues to be done purely mechanically;
that is, the required torque is furnished by the vehicle
drive train via the shaft 24.

- If the vehicle is in motion and the engine 12 is
off for example during braking or when centrifugal
energy is being utilized, the drive of the climate
control compressor 70 continues to be done purely
mechanically; that is, the still-present moment of the

shaft 24 is utilized. Since a nonpositive engagement with a drive shaft 27 of the vehicle wheels still exists, the vehicle is braked.

5 - If the vehicle is stopped and the engine 12 is turned off, the drive of the climate control compressor 70 is effected mechanically via the first electric machine E1, idling having first been selected by a gear controller 72. If enough energy can be furnished by a vehicle battery, then electrical air conditioning while
10 parked is accordingly already possible without additional storage means or components.

 - If the vehicle is stopped and the engine 12 is in operation, the drive of the climate control compressor 70 is effected mechanically and electrically. Once again, idling having previously been selected by the transmission converter 72. In this case a drive moment of the climate control compressor 70 is reinforced, stepped down, by the electric machine E1, with the gear ratio furnished via the planetary gear 32. Thus by the choice of an rpm of the electric machine E1, a compressor rpm can be determined.

 All these functions can be achieved by components known per se, which usually are already present anyway. For instance, in vehicles having the special
25 transmission 74, only the control of the electric machine E1 and of the transmission converter 72 need to be adapted accordingly. In the latter variant, still other elements could also be connected preceding the climate control compressor 70, such as a spur gear stage
30 or a reversible step-up gear. In this way, a maximum rpm and an rpm spread of the compressor rpm can be

limited, thus assuring the most unimpeded possible operation.

Claims

1. A drive arrangement for at least one auxiliary system of a motor vehicle, having an internal combustion engine, at least one supplementary motor, and a gear, characterized in that the gear (16) is a planetary gear (32), which is operatively connected to the engine (12) and the at least one supplementary motor (13), each via a respective input shaft (18, 20), and to the auxiliary system (22) via an output shaft (24).

2. The drive arrangement of claim 1, characterized in that the supplementary motor (13) is a second internal combustion engine.

3. The drive arrangement of claim 1, characterized in that the supplementary motor (13) is an electric machine (14).

4. The drive arrangement of claim 3, characterized in that the electric machine (14) is a starter generator of the internal combustion engine (12).

5. The drive arrangement of one of claims 2 or 3, characterized in that a control unit (30) is assigned to the drive arrangement (10) and detects an rpm (50) of the output shaft (24) and governs the supplementary motor (13) as a function of the rpm (50).

6. The drive arrangement of claim 5, characterized in that the control unit (30) includes a sensor (26), which measures the rpm (50) of the output

shaft.

5 7. The drive arrangement of one of the foregoing claims, characterized in that a sun wheel (34) of the planetary gear (32) is connected in a manner fixed against rotation to the input shaft (20) of the supplementary motor (14), and a carrier (36) for at least one planet wheel (38) is connected to the input shaft (18) of the engine (12).

8. The drive arrangement of one of the foregoing claims, characterized in that the auxiliary system (22) is a climate control compressor (70).

9. The drive arrangement of claim 8, characterized in that a spur gear stage and/or a reversible step-up gear precedes the climate control compressor (70).

10. The drive arrangement of claim 2, characterized in that the auxiliary system (22) is a generator.

11. The drive arrangement of one or more of the foregoing claims, characterized in that a relatively small electric machine (14) is used, which at a moderate power requirement makes a wide governing range possible.

12. The drive arrangement of claim 3, characterized in that the planetary gear (32), the electric machine (E1), and the output shaft (24) are components of a vehicle transmission (74).

13. A method for operating a drive arrangement

for at least one auxiliary system of a motor vehicle,
having an internal combustion engine, at least one
supplementary motor and a gear, characterized in that

5 a) the gear (16) is a planetary gear (32) with at
least two input shafts (18, 20) and at least one output
shaft (24), and a torque is transmitted from the engine
(12) and the at least one supplementary motor (13) via a
10 respective one of the input shafts (18, 20), to the
output shaft (24) and subsequently to the auxiliary
system (22); and

 b) a control unit (30) is assigned to the drive
arrangement (10) and detects an rpm (50) of the output
shaft (24) and governs the supplementary motor (13) as a
function of the rpm (50).

14. The method of claim 13, characterized in that
a set-point value or a set-point range for the rpm (50)
of the output shaft (24) is specified to the control
unit (30).

15. The method of claim 14, characterized in that
the supplementary motor (13) is an electric machine
(14), which can also be operated as a generator or
electric brake, and if the result of the torque
5 transmitted by the engine (12) is an rpm (50) that is
above the set-point value or set-point range for the rpm
(50) of the output shaft (24), the electric machine (14)
is operated as a generator.

16. The method of one of claims 13-15,
characterized in that the torque of the supplementary
motor (13) is increased if a power requirement to the

5 engine (12) is made as a consequence of a starting or acceleration event of the motor vehicle.

5 17. The method of one of claims 13-16, characterized in that the auxiliary system (22) is a climate control compressor (70), and the supplementary motor (13) is a first electric machine (E1) of a vehicle transmission (74), and as a function of a driving situation and an operating state of the engine (12), the following operating modes can be achieved:

10 - if the vehicle is in motion and the engine (12) is in operation, the drive of the climate control compressor (70) is effected mechanically;

- if the vehicle is in motion and the engine (12) is off (for example during braking or when centrifugal energy is being utilized), the drive of the climate control compressor (70) is effected mechanically;

15 - if the vehicle is stopped and the engine (12) is turned off, the drive of the climate control compressor (70) is effected via the first electric machine (E1), idling having first been selected by a gear controller 72; and

20 - if the vehicle is stopped and the engine (12) is in operation, the drive of the climate control compressor (70) is effected mechanically and electrically, idling having previously been selected by the transmission converter (72).

Abstract

The invention relates to a drive arrangement for at least one auxiliary system of a motor vehicle, having an internal combustion engine, at least one
5 supplementary motor, and a gear.

It is provided that the gear (16) is a planetary gear (32), which is operatively connected to the engine (12) and the at least one supplementary motor (13), each via a respective input shaft (18, 20), and to the
10 auxiliary system (22) via an output shaft (24).

(Fig. 1)

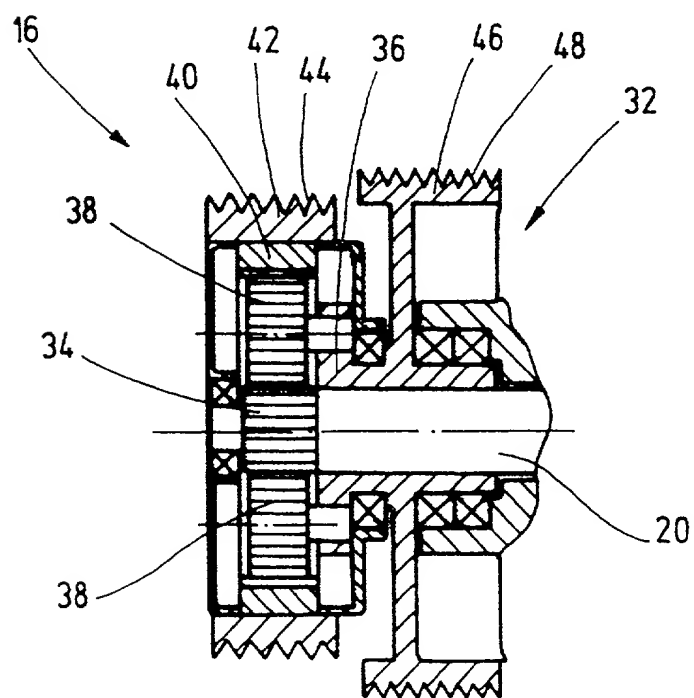
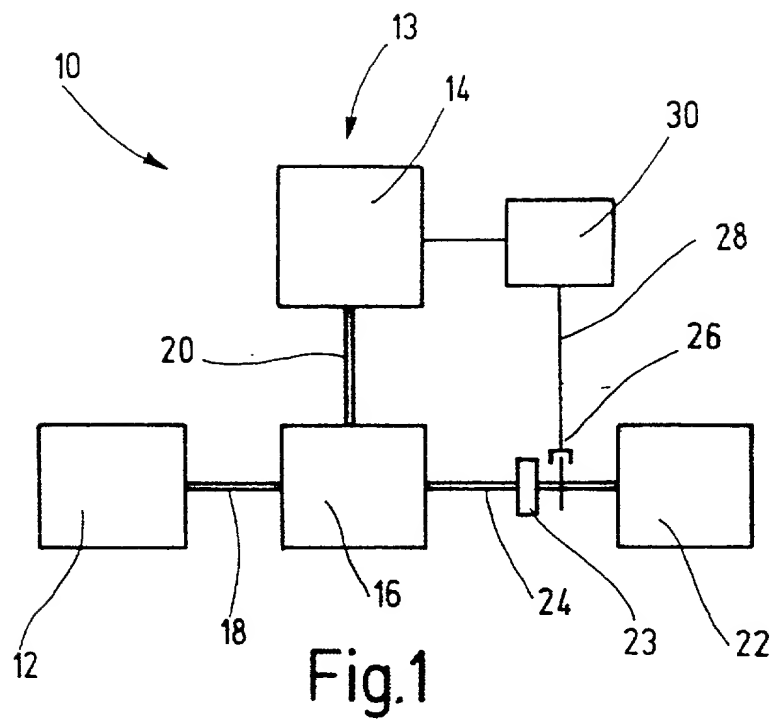


Fig.2

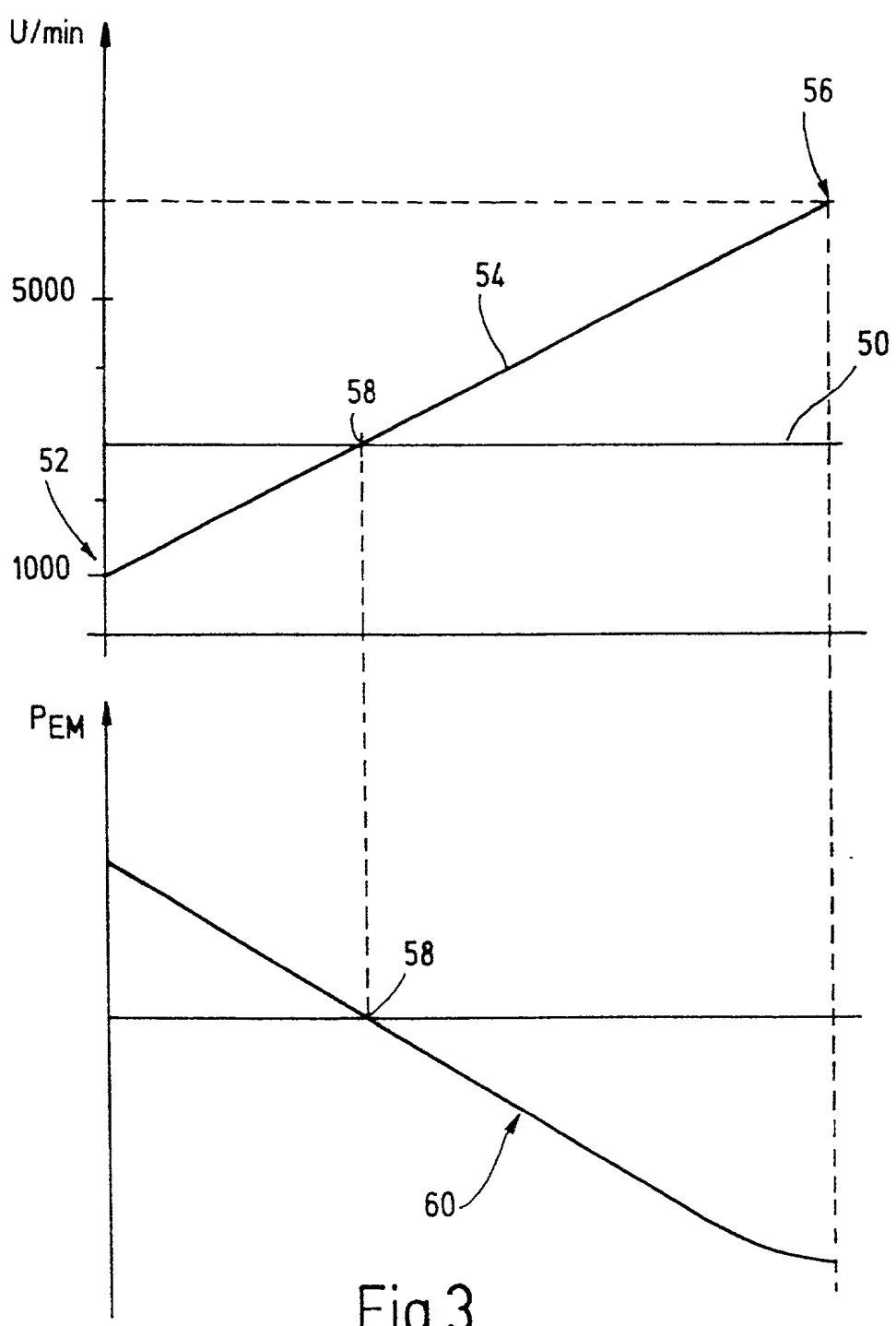


Fig.3

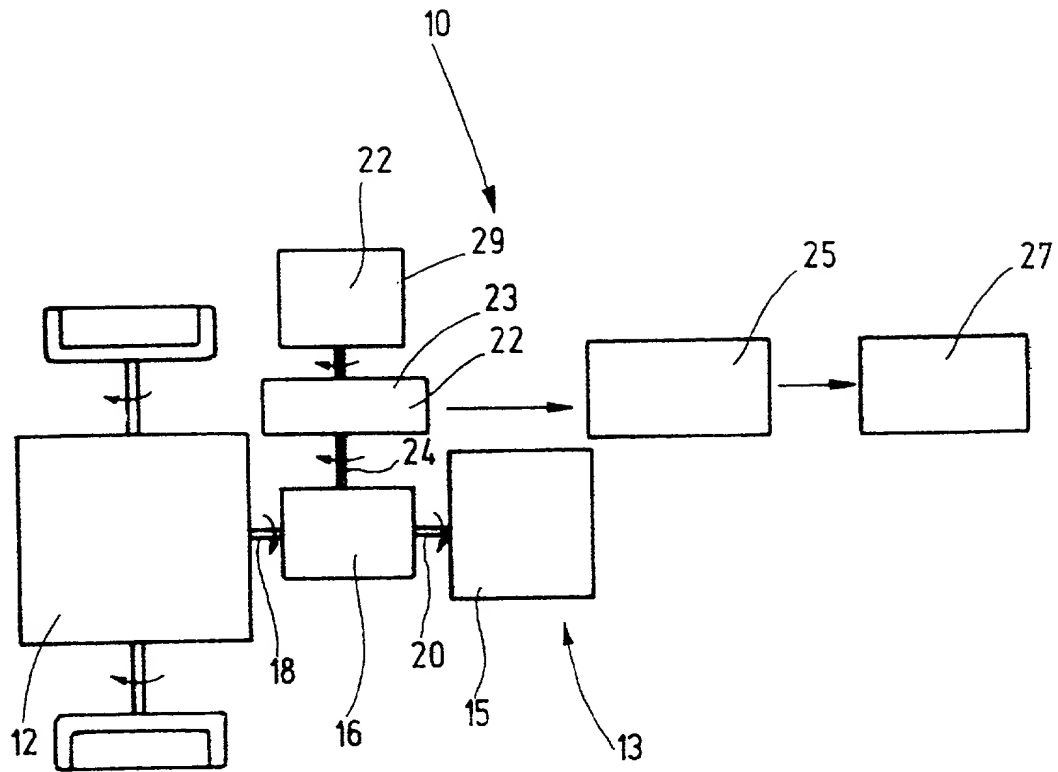


Fig.4

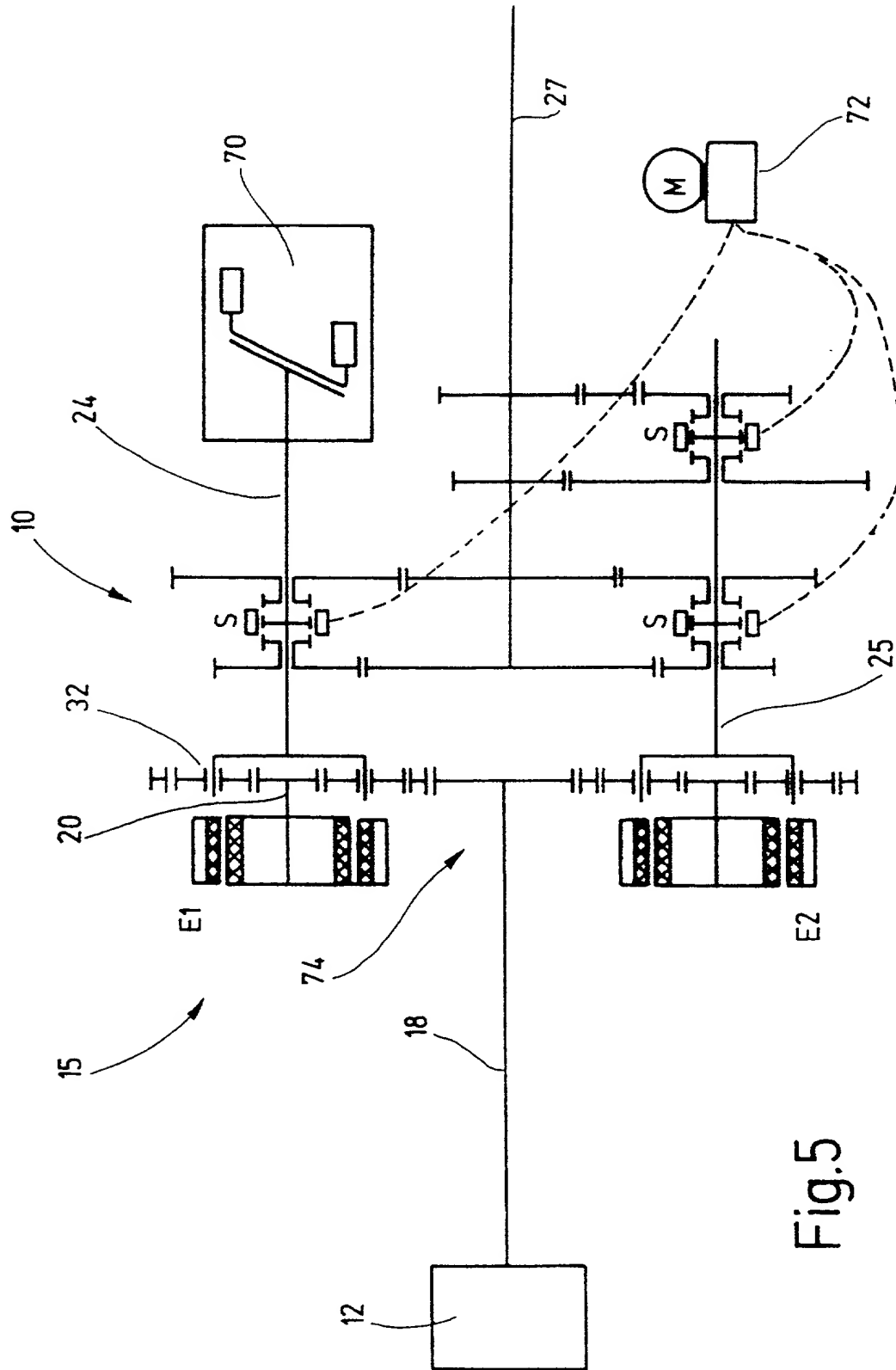


Fig. 5

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Siegfried SCHUSTEK
Ulrich HESSE
Daniel DAMSON

Hans-Ruediger WEISS
Klaus-Peter SCHNELLE

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **DRIVE ARRANGEMENT FOR AT LEAST ONE MOTOR VEHICLE AUXILIARY SYSTEM, AND METHOD FOR OPERATING THE DRIVE ARRANGEMENT** the specification of which was filed as PCT International Application number PCT/DE 00/00243 on January 31, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

<u>199 03 864.3</u>	<u>GERMANY</u>	<u>FEBRUARY 1, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u>199 51 833.5</u>	<u>GERMANY</u>	<u>OCTOBER 28, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u>199 60 681.1</u>	<u>GERMANY</u>	<u>DECEMBER 15, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with

the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

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